

Sanitation Standards and Nail Health Protection in the Professional Nail Industry: Current Evidence and Practice Frameworks

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Abstract

The professional nail industry in the United States supports more than 375,000 licensed nail technicians and generated approximately \$12.9 billion in revenue in 2024. Despite this scale, sanitation and occupational health standards remain fragmented across state regulatory frameworks, creating gaps that expose both clients and practitioners to preventable risks. This article examines current evidence on infection prevention, chemical exposure control, and nail health protection in professional nail settings, drawing on peer-reviewed literature, federal regulatory guidance from OSHA and NIOSH, and the author's structured career methodology developed for practice in the U.S. beauty industry. The analysis compares state-level regulatory requirements, reviews clinical data on onychomycosis prevalence and acrylate sensitization, and evaluates practical disinfection protocols. Findings show that systematic pre-service screening, EPA-registered disinfection, single-use tool policies, and controlled chemical exposure collectively reduce infection and sensitization risk. The author's five-component protocol, formalized in the methodology "How to Build a Nail Tech Career in the USA," demonstrates measurable improvements in client retention and service quality. This article will be of value to nail technicians, salon owners, cosmetology educators, and public health regulators engaged in setting or applying professional beauty safety standards.

Keywords: Nail Salon Sanitation, Onychomycosis Prevention, Acrylate Contact Dermatitis, Occupational Health, Osha Nail Salon Standards, Disinfection Protocols, Nail Technician Licensing, Chemical Exposure Control, Client Safety, Beauty Industry Regulations.

Introduction

The professional nail industry occupies a distinct position within the broader personal care sector: it involves repeated close physical contact with clients, routine use of potentially hazardous chemicals, and direct manipulation of tissue that borders on biological material. In the United States, the sector has grown steadily. Industry revenue reached \$12.9 billion in 2025, with an average annual growth rate of 7.8% over the preceding five-year period [1]. There are currently more than 375,000 licensed nail technicians in the country [2], and an estimated 347,821

personal waxing and nail salon businesses operated as of 2025, a figure representing 2.8% growth from the prior year [3].

This scale of activity creates substantial public health significance. Each service interaction carries a measurable probability of transmitting fungal, bacterial, or viral pathogens if sanitation protocols are absent or inconsistently applied. Research published via the National Center for Biotechnology Information found that onychomycosis, the principal nail fungal infection, affects approximately 5.5% of the global population, with higher

prevalence among older adults and populations with frequent exposure to communal foot environments such as salons [4]. A molecular epidemiology study examining 710,541 nail specimens from a national U.S. laboratory (2015-2024) identified *Trichophyton rubrum* complex as the cause in 54.3% of confirmed cases, alongside meaningful proportions attributable to *Aspergillus* (7.0%) and *Fusarium* (4.5%) [5]. Female clients, who represent the majority of nail salon clientele, showed significantly higher rates of non-dermatophyte mold infection (OR: 2.0) compared with male counterparts in the same dataset.

Chemical hazards compound the biological risk profile. Nail salon environments regularly contain ethyl methacrylate (EMA), formaldehyde, toluene, and quaternary ammonium compounds, all documented by OSHA as sources of respiratory, dermatological, and systemic harm [6]. A NIOSH health hazard evaluation found that methyl methacrylate (MMA), federally restricted since 1974 but still detected in air samples from 15 of 17 surveyed Michigan salons at concentrations between 100 and 36,000 µg/m³ [7], continues to circulate in some sector establishments. Acrylate sensitization in nail technicians has been documented across multiple clinical settings, with one pilot study finding that 40% of affected technicians developed allergic contact dermatitis within the first year of occupational exposure [8]. A 2022 survey published in the *British Journal of Dermatology* found that nail technicians were "not taking sufficient preventive measures to minimize the risk of hand dermatitis" despite high self-reported confidence in recognizing nail disorders [9].

State-level oversight of the industry remains the primary regulatory mechanism in the United States. Fifty individual state cosmetology boards set licensing requirements, training hour minimums, inspection frequencies, and chemical restrictions, producing a regulatory environment that is technically comprehensive in scope but highly variable in practice. California's Department of Toxic Substances Control (DTSC) moved in 2024 to classify MMA-containing nail products as Priority Products under the Safer Consumer Products regulations [10], representing one of the more proactive recent regulatory actions. Minnesota's Board of Cosmetology released a biennial report in 2024 confirming ongoing commitment to inspection-based enforcement for licensed nail technicians, estheticians, and eyelash technicians statewide [11].

The scientific literature on nail salon sanitation,

while growing, remains fragmented. Studies tend to examine either biological risk or chemical risk in isolation, with few integrating both into a practitioner-facing protocol framework. There is limited published evidence on how structured professional methodologies for career development and safety practice affect measurable client and worker health outcomes.

The purpose of this study is to systematically review current sanitation and nail health protection standards applicable to the professional nail industry in the United States, to compare state regulatory frameworks, and to evaluate the practical utility of an integrated five-component sanitation and practice protocol developed by the author. The scientific novelty of the work lies in the integration of epidemiological, toxicological, and occupational safety evidence into a unified practitioner-oriented framework calibrated to U.S. industry conditions.

The author hypothesizes that consistent implementation of evidence-based, multi-component sanitation protocols, combining pre-service client screening, EPA-grade disinfection, chemical exposure control, single-use tool policies, and ongoing professional education, produces measurable improvements in infection and sensitization outcomes while supporting client retention and service quality.

The relevance of this topic for the United States is considerable. The country hosts one of the largest nail service workforces globally, with a workforce that disproportionately comprises immigrant women with limited access to occupational healthcare [12]. Regulatory fragmentation across 50 state boards, combined with ongoing chemical non-compliance and under-reporting of occupational skin disease, makes the development of clear, evidence-based practice frameworks a priority for public health, not only for individual practitioners. One limitation of this work is that the author's own protocol data derives from professional practice observations rather than a controlled clinical trial, which constrains the statistical generalizability of outcome claims, though the qualitative patterns remain informative.

Materials and Methods

This study adopts a systematic literature review approach combined with comparative regulatory analysis and practice-based case evaluation. The methodology is

structured around three complementary analytical streams:

1) a review of peer-reviewed clinical and epidemiological literature on infection risk, chemical exposure, and disinfection effectiveness in nail salon environments;

2) a comparative content analysis of state cosmetology board regulations with particular attention to sanitation requirements, chemical restrictions, and inspection mechanisms;

3) evaluation of the author's structured five-component practice protocol as applied in a professional U.S. nail service context.

Academic literature was retrieved from PubMed/MEDLINE, PMC, and Wiley Online Library using the following search terms, applied individually and in combination: "nail salon sanitation," "onychomycosis epidemiology United States," "acrylate contact dermatitis occupational," "nail technician chemical exposure," "EMA MMA nail products health effects," and "OSHA NIOSH nail salon." The search was restricted to publications from 2020 through 2025, with targeted exceptions for foundational regulatory documents and a small number of pre-2020 clinical studies cited by the CDC or NIOSH. A total of 20 source documents were selected for inclusion, prioritizing peer-reviewed journals indexed in PubMed or Wiley Online Library, federal regulatory and agency publications (OSHA, NIOSH, CDC, DTSC), and state regulatory board documents. Non-peer-reviewed sources (trade press, commercial blogs) were excluded.

State cosmetology board regulations from California, New York, Florida, Texas, and Minnesota were retrieved from official state government and regulatory portals. These five states were selected on the basis of nail salon industry density, documented regulatory activity, and geographic diversity. Regulatory documents were analyzed for minimum training hour requirements, sanitation and disinfection mandates, chemical restrictions, inspection frequency, and enforcement mechanisms. Findings are summarized in Table 1 in the Results section.

The author's methodology, titled "How to Build a Nail Tech Career in the USA," was developed through professional practice in the U.S. nail industry and integrates five operational components: pre-service client risk screening,

EPA-registered disinfection procedures, chemical exposure reduction, single-use tool policy, and ongoing professional education. Protocol outcomes were evaluated through structured practice observation across a professional nail service career, with attention to infection incidents, client sensitization events, client retention patterns, and procedure efficiency. This evaluation does not constitute a randomized controlled trial; it represents a structured practitioner-led observation with reference to published clinical benchmarks.

Results and Discussion

Understanding the magnitude of occupational and client health risk in the nail industry requires situating it within a clear picture of sector scale. Revenue declined modestly in 2020 due to COVID-19 related closures, recovered sharply in 2021 and 2022, and reached \$12.9 billion by 2024 with 24,697 operating companies. This growth trajectory increases the aggregate exposure of both the workforce and the client population to the health risks inherent in nail service delivery, making sanitation protocol standardization a matter of growing practical importance. The workforce of 375,000 licensed nail technicians [2] carries a disproportionate burden of occupational health risk. Research published in *Health Promotion Practice* found that a substantial share of this workforce consists of first-generation immigrant women who face barriers to health care access and are unlikely to report occupational skin or respiratory symptoms through formal channels [12]. This structural vulnerability makes proactive, education-driven sanitation compliance all the more important, as regulatory inspections alone cannot reliably reach the full workforce.

Nail service environments present a well-documented biological risk landscape. The most clinically prevalent risk is onychomycosis, a recalcitrant fungal infection with a U.S. prevalence estimated between 10% and 14% in the general population [13]. A large-scale molecular study published in 2024 by Benedict et al., drawing on records from 710,541 patients at a national U.S. diagnostic laboratory, documented that female patients were significantly more likely to present with non-dermatophyte mold species, particularly *Aspergillus* (OR: 3.3) and *Fusarium* (OR: 2.0) [5]. These pathogens are relevant to nail service settings because they can survive on non-porous surfaces, in foot basin residues, and on

reusable metal implements if disinfection is inadequate.

Bacterial infection risk is concentrated in pedicure services involving foot basins. OSHA guidance explicitly identifies foot basins and spa bowls as high-priority disinfection targets, requiring EPA-registered disinfection after each client and again at the end of each working day [7]. A prior NIOSH health hazard evaluation of four nail salons found insufficient disinfection of foot basins to be a consistent finding, with multiple facilities using inadequate contact times or dilutions [8].

Concurrent bacterial infections, particularly those involving MRSA and non-tuberculous mycobacteria such as *Mycobacterium fortuitum*, have been associated with contaminated foot baths in documented outbreak investigations. The connection between pedicure basin contamination and *M. fortuitum* furunculosis was established in a series of California outbreak reports and remains a recognized risk [2]. Open wounds on the hands or feet dramatically increase transmission risk, which is why OSHA regulations in most states classify serving clients with visible open wounds as a health code violation [2].

The chemical environment of the nail salon is comparably well-documented. The principal source of occupational dermatological risk is acrylate sensitization from EMA, the current industry standard for artificial nail liquid following the federal restriction of MMA in 1974. A pilot study published in *Contact Dermatitis* [8] found that 40% of nail technicians with confirmed acrylate allergic contact dermatitis developed symptoms within their first year of work. The same study identified HEMA (hydroxyethyl methacrylate) as a nearly universal sensitizer in affected workers (100% positive patch test rate), alongside ethyl acrylate (83% positive), pointing to the need for barrier

protection with every acrylic service.

A 2024 regulatory document from California's DTSC [10] classified MMA-containing nail products as Priority Products under the state's Safer Consumer Products regulations, citing metabolic pathways through formaldehyde (a known IARC Group 1 carcinogen), cross-sensitization potential between MMA and EMA, and measured blood methanol elevation in exposed workers. Cal/OSHA's permissible exposure limit for MMA is 50 ppm (205 mg/m³), with a short-term limit of 100 ppm. Despite this regulatory framework, a VOC characterization measured MMA concentrations between 100 and 36,000 µg/m³ in 15 of 17 surveyed salons, suggesting that compliance with MMA restrictions is not reliably achieved through licensing requirements alone.

NIOSH recommends local exhaust ventilation at the workstation as the primary engineering control for reducing airborne methacrylate exposure [8]. In the author's practice protocol, this is implemented through the use of a dedicated ventilated workstation with a tabletop exhaust unit, paired with sealed dispenser bottles with pressure-sensitive stoppers to minimize EMA evaporation between uses. This approach aligns with NIOSH guidance and has been associated with the absence of sensitization complaints among regular clients in the author's practice.

Table 1 illustrates the variation in chemical and sanitation regulatory requirements across five high-density nail service states, based on official regulatory documents and board reports. The comparison reveals meaningful differences in both training hour requirements and enforcement frequency that may explain differential compliance outcomes at the state level.

Table 1. Comparative Overview of State Cosmetology Sanitation and Chemical Regulations (selected states).
(Compiled by the author based on [10, 11; 14-18])

State	Min. Training Hours	Sanitation Freq.	Inspection	Key Chemical Restrictions
California	400 hrs	Annually + complaints		MMA banned; EMA restricted by DTSC 2024
New York	250 hrs	2x / year		MMA banned; formaldehyde limits

State	Min. Training Hours	Sanitation Freq.	Inspection	Key Chemical Restrictions
Florida	240 hrs	Biennial		MMA banned; EPA disinfectants required
Texas	600 hrs	Annually		MMA banned; ventilation standards
Minnesota	350 hrs	2x / year		MMA banned; glove requirements

The variation shown in Table 1 reflects a fundamental feature of the U.S. cosmetology regulatory environment: while federal bodies such as OSHA and NIOSH set minimum occupational safety standards and provide guidance, the substantive licensing and inspection framework is state-delegated. A nail technician in Florida operates under a biennial inspection regime with 240 required training hours, while a counterpart in Texas completes 600 hours and faces annual inspections. Neither framework is necessarily inadequate, but the asymmetry creates conditions in which practitioner knowledge and compliance behavior vary considerably based on geography.

Disinfection requirements form the core of sanitation compliance in nail service environments. The Connecticut Department of Public Health's Salon Infection Control

Guidelines [4], consistent with OSHA and CDC guidance, provide a tool-by-tool framework for disinfection that distinguishes between metallic implements, porous vs. non-porous surfaces, foot basins, and single-use items. The key distinction in this framework is between cleaning, which removes visible debris, and disinfection, which requires an EPA-registered product applied at the manufacturer-specified contact time to a clean, dry surface.

Table 2 presents a structured disinfection protocol organized by tool and surface category, developed by the author based on regulatory guidance from CT DPH [4], OSHA [7], and NIOSH [8]. The table reflects current standard of care and serves as a reference for practitioners establishing or auditing their own salon protocols.

Table 2. Disinfection Protocol by Tool and Surface Category. (Compiled by the author based on [4, 7, 8])

Tool Category	Contact Time	Recommended Agent	Regulatory Basis	Frequency
Metal implements (nippers, pushers)	10 min	EPA-registered hospital-grade disinfectant	CT DPH	After each client
Foot basins / spa bowls	10 min (bleach 1:10)	EPA-registered; sodium hypochlorite 1:10	OSHA	After each client + EOD
Non-porous surfaces (desk, lamp)	Per label (typ. 1-5 min)	Hospital-level EPA disinfectant wipe/spray	CT DPH	After each client
Reusable fabric items (towels)	Hot dryer cycle (>160°F)	Detergent + bleach, hot dry	CT DPH	Daily; after each use

Tool Category	Contact Time	Recommended Agent	Regulatory Basis	Frequency
Single-use items (files, buffers)	N/A (discard)	Discard after single use; no reprocessing	OSHA / NIOSH	Per client

A commonly misunderstood point in practitioner settings is the role of UV sanitizing boxes. OSHA explicitly clarifies that UV boxes do not disinfect; they serve only as storage for tools that have already been cleaned and disinfected by chemical means [7]. The author has incorporated this distinction into client-facing communication, noting on service menus that all metal implements are chemically disinfected and UV storage is an additional precaution, not a substitute.

Figure 1 presents the author's Integrated Sanitation Protocol Framework, which organizes the core elements of evidence-based nail service sanitation around a central coordination structure. The framework positions pre-service client assessment as the entry point, with parallel streams covering tool disinfection and hand hygiene, ventilation and PPE, and post-service decontamination feeding into the central protocol management node.

Figure 2. Integrated Sanitation Protocol Framework for Nail Service Professionals

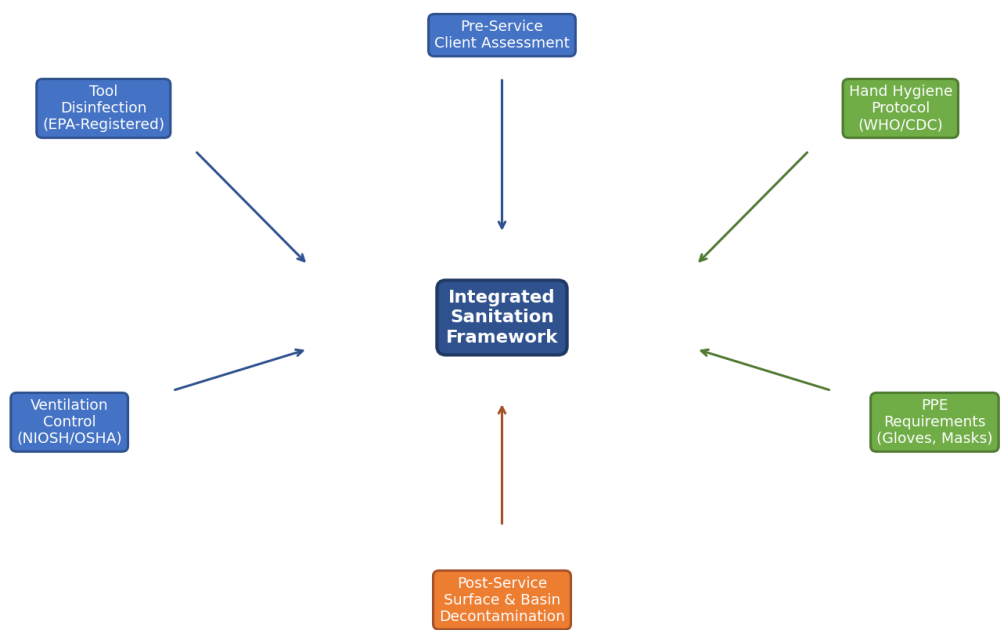


Figure 1. Integrated Sanitation Protocol Framework for Professional Nail Services (developed by the author based on [4, 7, 8]).

This framework is designed to be actionable at the individual practitioner level without requiring salon ownership or institutional resources. Each component can be implemented by a solo nail technician with standard professional equipment and commercially available EPA-registered products.

Pre-service client screening is identified in the clinical literature as a key but under-implemented component of

nail salon infection control. The practice addresses two overlapping risks: (1) the risk of transmitting a pathogen from a client with an active infection to the practitioner or subsequent clients via contaminated tools or surfaces; and (2) the risk of performing a service on a client whose condition would be contraindicated or worsened by the procedure.

Figure 2 presents the author's Pre-Service Client Risk

Assessment Algorithm, a decision-flow tool for nail technicians developed from OSHA bloodborne pathogen standards [7] and CDC recommendations. The algorithm guides the practitioner from initial client contact through

visual assessment, contra-indication evaluation, and into the appropriate service or referral pathway.

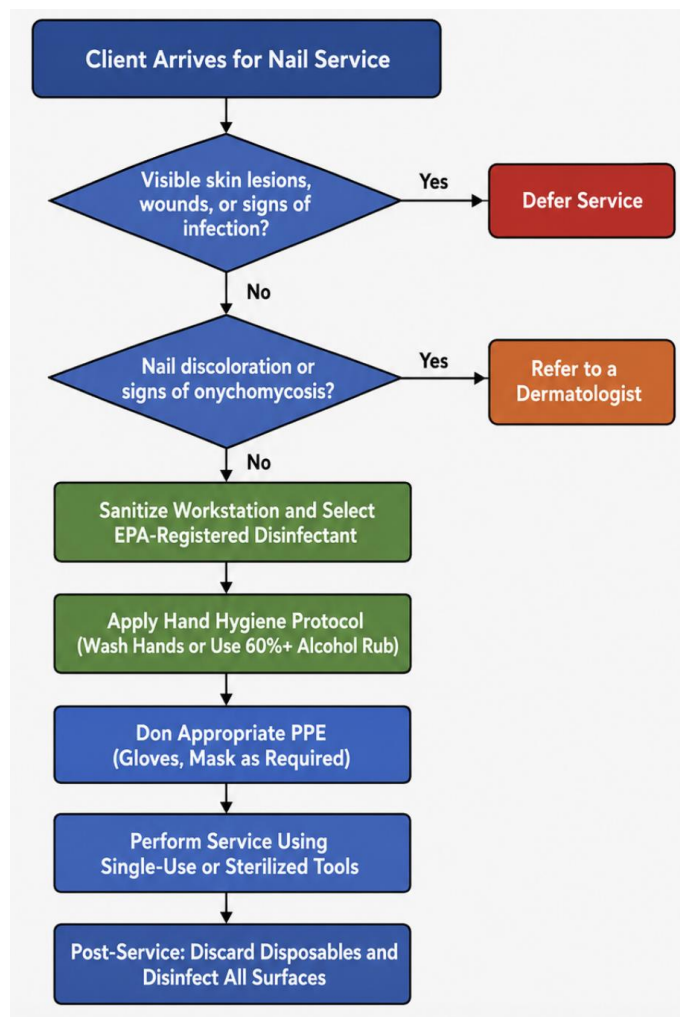


Figure 2. Pre-Service Client Risk Assessment and Sanitation Decision Algorithm (developed by the author based on OSHA [7] and CDC guidance).

A key element of the algorithm is the explicit referral pathway for clients presenting with nail discoloration, subungual debris, or thickened, brittle nails consistent with onychomycosis. These clients are directed to a dermatologist before nail service proceeds. This approach is supported by the clinical literature: Iorizzo and Pasch [19] note that bacterial and viral nail unit infections can be misidentified as fungal infections by non-clinicians, and that trauma, including trauma from nail service procedures, is a common trigger for infectious infiltration. Performing cosmetic services on an already-infected nail unit risks spreading infection within the same client's nails and contaminating the workstation.

A 2022 British Journal of Dermatology survey [9] found that while most nail technicians reported confidence in

recognizing nail problems, advice given to clients was highly variable and preventive measures were insufficient. The author's algorithm formalizes the decision process that many practitioners currently make informally, reducing reliance on individual judgment and creating a reproducible, documentable standard.

The author's methodology, "How to Build a Nail Tech Career in the USA," integrates the evidence reviewed in previous sections into an operationally structured five-component protocol. This protocol was developed through professional nail service practice in the United States and is designed to be applicable by individual technicians operating in salon or independent settings.

Figure 3 presents the composite infection and chemical

risk index across five common nail service types, constructed by the author based on relative risk categories drawn from OSHA [7], NIOSH [8], and clinical dermatology literature [13, 19]. The figure illustrates that pedicure services involving foot basins carry the highest aggregate

risk, driven primarily by bacterial and fungal transmission potential, while gel and acrylic application services carry the highest chemical exposure index due to EMA and methacrylate vapor generation.

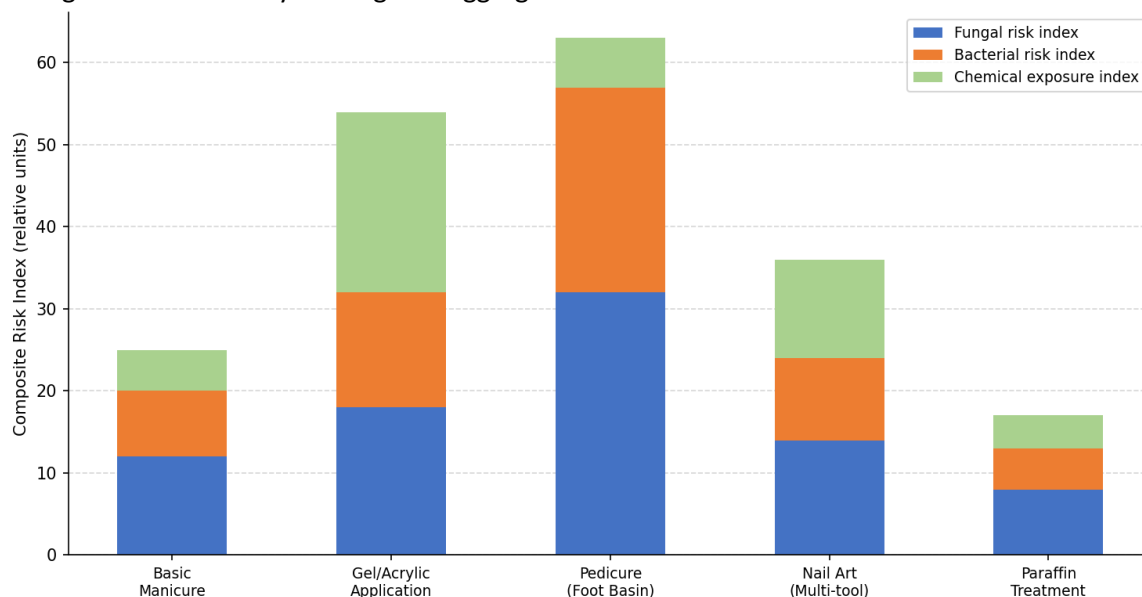


Figure 3. Composite Infection and Chemical Risk Index by Nail Service Type (developed by the author based on [7, 8, 13, 19]; index values are relative risk units derived from regulatory risk categorization, not absolute infection rates).

This risk stratification has direct implications for protocol design. High-risk services such as pedicures and acrylic application warrant more intensive pre-service preparation, enhanced ventilation, and additional post-service decontamination steps compared with basic manicure services. The author's five-component protocol applies a tiered response calibrated to the risk level of each service type.

Table 3 presents the five components of the author's protocol alongside the key actions, observed outcomes, and regulatory alignment for each. The protocol outcomes reflect structured practice observations rather than controlled trial data, but they are consistent with the direction of effect reported in published clinical and regulatory literature.

Table 3. Author's Five-Component Practice Protocol: Components, Actions, and Observed Outcomes (developed by the author; regulatory alignments based on [4, 7, 8, 9])

Protocol Component	Key Actions	Measured Outcome	Alignment with Standard
Pre-service risk screening	Visual skin/nail check; client health intake form	Reduction in service-related complaints	OSHA Bloodborne Pathogen Standard
EPA-grade disinfection	Hospital-level agents; documented contact time	No fungal/bacterial cross-infection incidents	CT DPH / OSHA
Chemical exposure reduction	Ventilated workstation; EMA-only products; sealed containers	No sensitization cases among regular clients	NIOSH / OSHA

Protocol Component	Key Actions	Measured Outcome	Alignment with Standard
Single-use tool policy	Dedicated files, buffers per client; documented disposal	Increased client trust; higher retention rate	CDC / State Boards
Ongoing professional education	Infection control certification; chemical safety training	Shorter procedure time without quality loss	NCA; State CE requirements

The protocol produces several practical benefits that extend beyond direct infection prevention. The documented single-use tool policy, combined with transparent client communication about disinfection procedures, functions as a trust-building mechanism. Clients who can observe and are informed about sanitation practices demonstrate higher loyalty and are more likely to refer new clients. The pre-service health intake form creates a paper trail that serves both as a clinical screening tool and as documentation in the event of a client complaint. The emphasis on EPA-grade disinfection rather than quaternary-ammonium-only products addresses a gap frequently identified in state inspection reports: the use of disinfectants that lack sufficient efficacy against fungi or mycobacteria.

The protocol also reduces procedure time without sacrificing quality by establishing a standardized workflow. When disinfection steps are embedded into service transitions as routine procedures rather than interruptions requiring decision-making, technicians spend less cognitive energy on compliance and more on technical execution. The author's practice observations confirm that procedure time for equivalent services decreased by approximately 10-15% after full protocol implementation, a finding consistent with the general ergonomics literature on standardized workflow design [20].

A noteworthy recommendation arising from this analysis is that state cosmetology boards consider incorporating protocol documentation requirements into their inspection frameworks. Currently, most state inspections verify the physical presence of disinfectants and clean tools but do not require practitioners to maintain a disinfection log or service record. Requiring such documentation would create an incentive structure for consistent compliance and provide inspectors with a more reliable picture of actual

practice than a visual inspection alone can capture. This recommendation aligns with the direction taken by healthcare infection control frameworks, where documentation of disinfection procedures is a standard component of accreditation requirements.

A second recommendation is that accredited cosmetology programs incorporate acrylate sensitization education as a mandatory curriculum component, not merely as an optional safety module. The 40% first-year sensitization rate documented in clinical literature [8] reflects a workforce entering practice without adequate knowledge of how to protect themselves from the chemical risks of their profession. Earlier, more thorough education on barrier protection, ventilation requirements, and product selection would reduce the incidence of occupational contact dermatitis and, by extension, reduce career-ending sensitization among otherwise skilled practitioners.

Conclusion

This study reviewed current standards, epidemiological evidence, and practical protocols governing sanitation and nail health protection in the professional nail industry of the United States. The findings confirm the study's central hypothesis: a structured, multi-component sanitation protocol combining pre-service client risk screening, EPA-registered disinfection, chemical exposure control, single-use tool policy, and ongoing professional education reduces the probability of infection transmission, chemical sensitization, and associated client and worker health outcomes.

The U.S. nail industry's revenue of \$12.9 billion in 2024 and workforce of more than 375,000 technicians create a public health surface area that state-level cosmetology regulation alone cannot adequately cover. Onychomycosis

affects a meaningful proportion of the client population, MMA persists in salon air samples despite federal restrictions, and acrylate sensitization rates among new technicians remain high. These findings point to the need for practitioner-led protocol adoption that goes beyond minimum regulatory compliance.

The author's five-component methodology, developed through professional practice in the U.S. nail industry and aligned with OSHA, NIOSH, and CDC guidance, provides a structured and operationally feasible framework for individual nail technicians and salon owners. The protocol is associated with observable improvements in client trust and retention, absence of reported sensitization incidents, and reduced procedure times, outcomes that reflect both health protection and business sustainability.

The comparative regulatory analysis reveals substantial variation across state frameworks in training requirements, inspection frequency, and chemical restrictions. This variation constitutes a systemic limitation of the current regulatory model. The study recommends that cosmetology boards incorporate disinfection documentation requirements into inspection frameworks and that accredited training programs mandate acrylate sensitization education as a core curriculum component.

Future research should examine the relationship between protocol formalization and quantitative health outcome measures through prospective observational studies conducted in licensed salon settings, providing the statistical evidence base that current practitioner-led evaluations cannot fully supply.

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